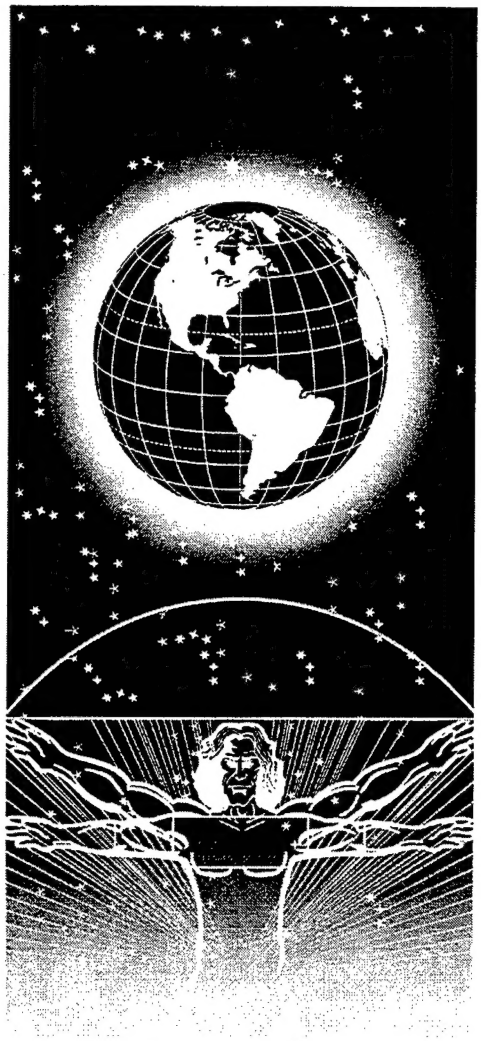
AFRL-HE-WP-TR-1998-0093



UNITED STATES AIR FORCE RESEARCH LABORATORY

A HUMAN FACTORS EVALUATION OF ESAR/ATR INTEGRATION FOR THE THEATER MISSILE DEFENSE (TMD) AUTOMATIC TARGET RECOGNITION (ATR) RAPID RESPONSE TARGETING AGAINST MOBILE GROUND TARGETS (RTM) PROGRAM

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JULY 1998

INTERIM REPORT FOR THE PERIOD 1 APRIL 1997 TO 1 MAY 1998

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TECHNICAL REVIEW AND APPROVAL

AFRL-HE-WP-TR-1998-0093

This report has been reviewed by the Office of Public Affairs (PA) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

FOR THE COMMANDER

HENDRICK W. RUCK, PhD
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REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	July 1998	Interim Report; 1 April 97 - 1 May 98

4. TITLE AND SUBTITLE
A Human Factors Evaluation of ESAR/ATR Integration for the Theater Missile Defense (TMD) Automatic Target Recognition (ATR) Rapid Response Targeting Against Mobile Ground Targets (RTM) Program

5. FUNDING NUMBERS
C: F41624-94-D-6000
PE: 62202F
PR: 7184
TA: 10
WU: 44

6. AUTHOR(S)
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8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Air Force Research Laboratory, Human Effectiveness Directorate
Crew System Interface Division
Air Force Materiel Command
Wright-Patterson AFB, OH 45433-7022

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
AFRL-HE-WP-TR-1998-0093

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This report describes a human factors evaluation of the target prosecution benefits of integrated enhanced synthetic aperture radar (ESAR) and automatic target recognition (ATR) technologies. Workstation operators aboard E-8C Joint Surveillance Target Attack Radar System (JSTARS) aircraft field-tested integrated ATR information and ESAR imagery during performance of mobile missile launcher targeting tasks on a series of demonstration flights. Two methods of data collection were used: post-flight questionnaires collected subjective operator assessments, and a human factors engineer conducted in-flight observation. The evaluative goal was to assess operator acceptance and to establish guidelines for the integration of ATR and ESAR capabilities on the JSTARS.

Results included significantly positive ratings for increase in situation awareness, somewhat decreased or unchanged ratings for workload, and no reports of increase in visual fatigue. Three of four operators recommended the incorporation of an integrated ATR/ESAR imagery capability into the JSTARS graphic display. Operators also requested inclusion of ATR numeric confidence ratings and that display of ATR information be optional. Human factors design recommendations cited existing military standards and human factors industry guidelines for improved displays and display interfaces.

14. SUBJECT TERMS
automatic target recognition (ATR), enhanced synthetic aperture radar (ESAR), mobile targets, target detection, Joint Surveillance Target Attack Radar System (JSTARS), theater missile defense (TMD), operator performance, image analysis, human system interface (HSI), displays

15. NUMBER OF PAGES
23

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	SAR

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PREFACE

This effort was conducted by the Information Analysis and Exploitation Branch, Crew System Interface Division, Human Effectiveness Directorate of the Air Force Research Laboratory (AFRL/HECA), Wright-Patterson AFB OH, under Work Unit 71841044, "Crew-Centered Aiding for Advanced Reconnaissance, Surveillance, and Target Acquisition." It was supported by Logicon Technical Services, Inc. (LTSI), Dayton, Ohio, under Contract F41624-94-D-6000, Delivery Order 0007. Mr. Don Monk was the Contract Monitor.

The authors wish to acknowledge the guidance, support, and encouragement of Mr. Gary Martin and Ms. Shirley Morrison of the Air Force Theater Missile Defense Attack Operations Program Office of the Aeronautical Systems Center (ASC/FBXT); Captain Dennis Hardesty of OLAT ESC JTF/ENR, Melbourne, Florida; as well as that of the Air Superiority Division of Headquarters Air Combat Command (HQ ACC/DRA).

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Enhancing the capability of U.S. forces to detect, locate, attack, and destroy theater missiles in all phases of conflict and theaters of operation has become a high defense priority since Operation Desert Storm. Recently, the Theater Missile Defense Automatic Target Recognition (TMD-ATR) and Rapid Response Targeting Against Mobile Ground Targets (RTM) programs merged and conducted a joint effort to explore technologies to advance this capability. The effort involved the use of integrated advanced synthetic aperture radar (SAR) and ATR technologies, the efficacy of which was tested in a series of target detection demonstration flights. Specifically, real-time ATR algorithms developed by Sandia National Laboratories were integrated with enhanced SAR (ESAR) sensor imagery in order to investigate the ability of operators aboard the E–8C Joint Surveillance Target Attack Radar System (JSTARS) aircraft to detect, locate, and identify mobile missile launchers on the ground.

Despite recent advances in ATR systems, there is consensus that the human operator will remain "in-the-loop" as an integral part of near and mid-term target acquisition systems (Kuperman, 1997; Aerospace Daily, 1996). The consideration of human system interface (HSI) issues is critical to further development and integration of these systems. In this regard, a HSI-oriented human factors evaluation of the ESAR/ATR integration concept was conducted in support of the ESAR/ATR integration concept. The following report documents the results of this evaluation. The human factors assessment was based on task analysis results, flight crew questionnaire responses, and the direct observation of flight crew performance by a human factors engineer, who participated in an 11-hour demonstration flight. The evaluation objective was to establish guidelines for the integration of ATR and ESAR within JSTARS.

HUMAN FACTORS EVALUATION

The primary objectives of the human factors evaluation of the ESAR/ATR integration were to:

- Assess the target prosecution benefits of the integration of ATR information (target identification [ID], cue box, ATR results summary) with ESAR imagery
- Identify user requirements for ATR information using input from experienced Joint Test Force (JTF) personnel who operated the system prototype
- Provide HSI design guidelines and recommendations for future ESAR /ATR integration efforts

The objectives outlined above were accomplished using the following techniques:

I. Image analyst (IA) task analysis

II. JTF operator post-demonstration flight questionnaire

III. In-flight observations and guidelines review by a human factors engineer

I. Image Analyst Task Analysis

The task analysis was performed during crew familiarization and by interviews with two JTF image analysts. The task analysis consisted of a simple task decomposition procedure. The task decomposition served to delineate the specific tasks required of the ESAR/ATR workstation operator in order to facilitate the definition of specific information display and control requirements. Definition of these requirements is useful in determining practical methods of integrating ATR with ESAR imagery. A synopsis of the task analysis results showing the primary tasks and information requirements are listed in Table 1. In short, the tasks of detecting, identifying, designating, and handing-off a designated target were accomplished in several steps, beginning with the use of the ATR software to retrieve the SAR image file. The image was then overlaid with the ATR to identify and designate the Transporter-Erector-Launcher (TEL). This information was then available for dissemination to the fighter by way of verbal report. It should be noted

that the ATR Tool was not specifically designed to support the imagery analyst in target acquisition tasks, but rather to retrieve and save images, manage files, and to modify the ATR information. The ATR Tool display was also totally unrelated to the existing JSTARS graphics display and its associated functions.

Table 1: JTF Workstation Operators Tasks/Subtasks and Information/Control Requirements

JTF Workstation Operator Tasks/Subtasks	Information and Control Requirements

• ESAR Image File Management
  • Retrieve Image Files
  • View / Assess Quality of Images
  • Store Image Files
	JSTARS Graphics Display
	ATR Tool Software Interface
	Available Files Listing
	SAR Image
	Input Device

• ESAR Image Manipulation
  • Adjust Brightness / Contrast
  • Zoom
	JSTARS Graphics Display
	Pull down Menus
	SAR Image
	Toolbar of Image Editing Options
	Input Device

• Visual Search and Target Identification
  • Assess Image Quality
  • Identify Scene Objects
	JSTARS Graphics Display
	Pull down Menus
	SAR Image
	Toolbar of Image Editing Options
	ATR Target ID information
	Target location coordinates

• Pass Information to Ground Agencies / Fighter
  • Determine location coordinates
  • Cut/paste target chips
  • Save Images
  • Send Images
	JSTARS Graphics Display
	Pull down Menus
	SAR Image
	Toolbar of Image Editing Options
	ATR Target ID information
	Target location coordinates

Figure 1 below shows the workstation configuration aboard the E8–C JSTARS.

Figure 1: JSTARS Operator Workstations

II. JTF Operators Questionnaire

A post-flight questionnaire was completed by four JTF aircrew, each of whom operated the JSTARS graphics display workstation during ESAR/ATR data collection demonstration flights. The questionnaire was designed to collect operator input in the areas of:

- ATR Information (target descriptions and cue boxes)
- ESAR E–4 and E–8 Imagery (representing medium and high resolution, respectively)
- Human-Machine Interface

Three of the four operators had prior SAR experience on the E–8 JSTARS platform, ranging from 2 to 3 years and a total of 50 to 500 hours. Two respondents defined their current crew position as surveillance, another as weapons operator, and the fourth as an Aerial Observer Technician (AOT). Tabulated questionnaire responses may be found in Appendix A.

ATR Information

The ATR information consisted of the color-coded boxes, text or symbols that related to the ATR designations. The information was manifested across five information types: a *Target Description* which identified the missile orientation on the TEL (i.e., 'TEL UP' signified the missile was erect and in launch configuration, 'TEL DOWN' indicated the missile in stowed position, while 'TEL OFF' indicated the absence of a missile on the TEL); *Target Coordinate* information, which provided the x, y pixel location of the target on the SAR image; *ATR Cue Boxes* which enclosed the object identified by the autoclassifier; an *ATR Results Summary*, an optional window selectable by the operator, which portrayed the probability value assigned to the designated object; and an *ATR Color Coding* option, which permitted the operator to specify the color-coding of the displayed ATR information.

Results of the questionnaire indicated that all operators found the target identification description (e.g., TEL UP) useful in aiding target acquisition and identification. Three operators stated that the target location coordinates should be presented adjacent to the target ID label on the ATR overlay. Similarly, all operators found the overlaid ATR information useful in aiding target prosecution and none reported that it cluttered the display. Two operators commented that the ATR cue boxes enabled them to quickly find and identify both real and potential targets. The additional display of the confidence rating for the ATR declaration was cited as a needed improvement by three operators.

The impact of the five types of ATR information was also assessed in regard to situational awareness (SA) and workload using a five point rating scale. The lower end

of the scale ('1' or '2') indicated that the ATR information had a *negative* impact on performance, such as reducing situational awareness or increasing workload; mid-scale (a value of '3') represented a *neutral* stance, whereby the ATR information neither increased or decreased SA or workload; while the high end ('4' and '5') represented *positive* impacts of the ATR information on increasing situational awareness or reducing workload. Four operators rated the impact on SA, of whom three also responded to the question on impact on workload. The average ratings obtained for SA and workload are presented in Tables 2 and 3 below.

Table 2: Average Ratings for Impact of Type of ATR Information on SA

Type of ATR Information	Target Description	Target Coordinates	ATR Cue Boxes	ATR Results Summary	ATR Color Coding
Impact on SA	4.5	4.5	4.75	4	4.75

SA: 1 = Significantly Negative 3 = None 5 = Significantly Positive

Table 3: Average Ratings for Impact of Type of ATR Information on Workload

Type of ATR Information	Target Description	Target Coordinates	ATR Cue Boxes	ATR Results Summary	ATR Color Coding
Impact on Workload	2.7	2.7	3.7	2.3	3.3

Workload: 1 = Significant Increase 3 = None 5 = Significant Decrease

In summary, all four operators rated the ATR information as useful and as having a positive impact on SA. Of the three respondents who also rated workload, two responded that the ATR cue boxes and color coding "somewhat decreased" workload.

The other types of ATR information, on average, were rated as having no impact on workload.

ESAR E–4 and E–8 Imagery

While both E–4 and E–8 imagery were available during the mission, only one of the four operators actually used E–4 imagery; however, that operator rated it as having a "somewhat positive" effect in aiding target acquisition and identification. All four operators rated the E–8 imagery useful in aiding target acquisition, and each one reported a noticeable enhancement in resolution over standard SAR imagery. The ESAR E–8 imagery was rated as having a positive impact on increasing SA (subject responses split between "somewhat positive" and "significantly positive"). No one reported the E–8 imagery as having any additional effect on visual fatigue.

Human Machine Interface

Each operator rated the HMI software developed for the demonstration (the ATR Tool) with respect to impact on workload, its effect on image handling and targeting operations, and the overall value it added to the integrated system capabilities. It should be noted that the ATR Tool was adapted from Khoros (C+) as a developmental tool for use by Sandia National Laboratory engineers and the Northrop Grumman integration team.

All four operators reported that the HMI was easy to learn and understand. With regard to the HMI's impact on workload, two rated it as having a "somewhat negative" effect by increasing workload, one reported a "somewhat positive" effect by reducing workload, and the fourth reported "no effect" on workload. Two operators assessed the overall value of the HMI as "somewhat positive," while two rated it as having a "somewhat negative" value. Image handling problems that were noted consisted of the loss of target location coordinates when cropping a portion of an image to save, and the loss of the ESAR display when trying to view the normal graphics display. One operator commented that refreshing the menu to update the SAR file listing was a feature he

disliked. Three operators commented that the ESAR/ATR capability should be integrated into the JSTARS graphic display instead of operating as a stand-alone system.

III. Observations, Established Guidelines and Recommendations

Displays used in tactical and command and control operations must be designed to aid the user in developing and maintaining good SA (Walrath, 1996). There are several general and specific design guidelines available to aid in the design of workstation displays and controls. The two primary guidelines used for the current effort were Salvendy's 1987 *Handbook of Human Factors*, and the 1989 *MIL-STD-1472D, Human Engineering Design Criteria for Military Systems, Equipment and Facilities.* Walrath (1996) also provides relevant guidelines and considerations for the display of information. (The guidelines and recommendations discussed in the following paragraphs refer to the ATR Tool developed by the ESAR/ATR integration team.)

ATR Color Coding

The use of color coding is helpful when an operator must search for specified information and symbol density is high (Salvendy, 1987). The HMI prototype allowed the operator to selectively color-code the ATR cue boxes at each level of detection: (1) Focus of Attention (FOA), (2) Second Level Detection (SLD), and (3) ID (cue boxes and associated target identification labels). It should be noted that these levels corresponded to the three levels of processing conducted by the ATR algorithm in classifying a TEL, not to the operator's task. Furthermore, it was only when the image 'passed' at each level, that its classification was reported. Although the operators generally favored the option to select preferred colors for displaying this information, a single, consistent color scheme for all workstations is recommended. *MIL-STD-1472D* (1989) states that consistent, meaningful codes should be used for user-computer interface display coding. The use of a consistent color scheme reduces the probability of misidentification errors, especially when operators are viewing multiple workstations and SAR images. Red, yellow, and green (or white) typically are used to indicate specific conditions. Red

signals the information is of immediate attention, yellow indicates caution, and green (or white) denotes fully operational or satisfactory. It is recommended that these colors be used when coding ATR information. Redundant coding (distinctive cue box shapes) of ATR information is also recommended (*MIL-STD-1472D*, 1989; Silverstein, 1987). For example, the ID level detections should be cued using a symbol that is different from those used for the two other detection levels.

Target Description Labeling

The ATR information contained target ID labels denoting target name and condition (e.g., TEL DOWN). It was observed during the demonstration flights that, when overlaid on the SAR image (presented in gray scale), red text was more difficult to read compared to green, yellow, or white text. This is probably attributable to differences in CRT luminance levels as a function of color. CRT output luminances are typically brighter for green, blue, and white. Ambient illumination (i.e., overhead lighting) also can affect the luminance contrast and apparent color of information displayed on the CRT (Silverstein, 1987). Therefore, it is recommended that if red is used as a color for target labeling, both letter size and brightness level should be increased. *MIL-STD-1472D* (1989, para. 5.5.5.14 - 5.5.5.15) also provides guidelines for determining display symbol and character height as a function of viewing distance. Future ESAR/ATR integration should be developed with careful attention to these guidelines to ensure text readability.

ATR Information Selectability

Additionally, it was recommended that the overlaid ATR information be made selectable or de-selectable using a simple ON/OFF (toggle) switch displayed as part of the menu.

Toolbars

As revealed in the task analysis, there are several repeated image manipulation and file retrieval operations required of the workstation operator when performing an activity. The existing software interface is keystroke intensive, requiring users to input a sequence of commands and employ a series of menus in order to open windows to accomplish

simple tasks. Linking the associated operations and displaying each task or activity as an icon on a 10 - 12 item toolbar would allow easier and quicker access to these functions.

Content of ATR Information

The ATR information overlay consisted of color-coded cue boxes and target ID labels (e.g., TEL UP, TEL DOWN) for the ID level of the ATR algorithm output. During the flight demonstration and crew familiarization, several operators noted that the inclusion of height, width, and length information for those targets with TEL ID declarations would be useful. The JTF operators also desired a simple numeric ATR confidence rating (e.g., 0.80) to be displayed along with the ATR output.

CONCLUSIONS AND RECOMMENDATIONS

This evaluation was conducted to assess the utility of the integration of ATR information and ESAR imagery as an operator performance enhancement for the acquisition and identification of time-critical-targets (TCT's). Both the JTF questionnaire results and in-flight observations indicated that the integration of the ESAR/ATR capabilities within the JSTARS platform is a technology advancement accepted by the users in this study. Such technology could potentially improve target prosecution performance. These new capabilities were also reported to have a significant effect on increasing SA during the demonstration flights without increasing workload. The evaluation also demonstrated the critical role of eliciting operator input to aid in the system design, development, and evaluation process.

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GLOSSARY

AOT	Aerial Observer Technician
ATR	Automatic Target Recognition
CRT	Cathode Ray Tube
ESAR	Enhanced Synthetic Aperture Radar
FOA	Focus of Attention
HSI	Human System Interface
IA	Image Analyst
ID	Identification
JSTARS	Joint Surveillance Target Attack Radar System
JTF	Joint Test Force
RTM	Rapid Response Targeting Against Mobile Ground Targets
SA	Situational Awareness
SAR	Synthetic Aperture Radar
SLD	Second Level Detection
TCT	Time Critical Target
TEL	Transporter/Erector/Launcher
TMD	Theater Missile Defense

APPENDIX A: TMD/RTM AIRCREW QUESTIONNAIRE OPERATOR INTERFACE ASSESSMENT RESULTS[1]

Subject Background & Experience

SUBJECT BACKGROUND								
Subject #	**Rank**	**Age**	**Crew Position**	**Current Aircraft**	**Flight Hrs.**	**Prior Aircraft**	**Flight Hrs.**	**Mission Date**
1	CAPT	36	WPNS/SURV	E8	500	E-3	1300	?
2	SMSGT	38	SURV	E-8	450	E-3	2300	16 Oct 97
3	TSGT	38	AOT	E-8	350	E-3 EC-130	2500 500	6 Nov 97
4	CAPT	29	WO	E-8C	50	E-3	2400	?

SUBJECT SENSOR EXPERIENCE											
Subject	**Radar Type**						**Operational Activity**		**Other Experience**		
#	**SAR**	**Yrs.**	**IR**	**Yrs.**	**EO**	**Yrs.**	**Nav**	**Wpns Del**	**System**	**Type**	**Yrs**
1	E-8	2	N	NA	N	NA	N	N	NA	NA	NA
2	E-8	3	NA	NA	NA	NA	Y	Y (Sim)	E-3	ESM	2
3	E-8	3	NA	NA	NA	NA	NA	Y (Sim)	E-3	?	7
4	N	NA	N	NA	N	NA	NA	NA	E-3 FPS 117	Air Surv. GB Surv.	?

Operational TMD Experience:

Please list the 3-5 primary tasks that you perform during a typical TMD mission or recent TMD exercise/demonstration you have participated in.

(n = 3) Sub. # 4 had not recently performed a TMD excercise or demo.

The three other respondents reported each of the tasks below:

- target search
- pass target information to ground agencies / fighters
- pass target updates
- develop target pictures to send
- ID other relevant terrain features for updates

[1]Please Note: The aggregated mean responses to questions G. and H. in Section I. (in bold) are reported in the Human Factors Evaluation section of the report in Tables 2 and 3.

I. Targeting Information / ATR Cueing

Ratings were given on a 5 point scale: 1= Not Important 5 = Very Important

INFORMATION TYPE **Rate importance of the type of information towards completion of a typical mission.**						
Subject #	Target Description	Target Coordinates	ATR Confidence Levels	ATR Cue Boxes	ATR Results Summary	Other Information
1	5	4	5	5	4	
2	5	5	5	5	5	
3	5	5	5	5	5	
4	5	5	5	3	3	

A. Did you find the targeting information (e.g. coordinates, description) displayed useful? Please explain.		
Subject #	Y/N	Comment
1	Y	Somewhat useful. I didn't see any coordinates displayed on the GD that would have been helpful. The ID was displayed fine.
2	Y	Very useful, but the coordinates for target ID need to be displayed below ID on the GD.
3	Y	The coordinate display was very useful, but you need to have the capability to display any type of coordinate system and have easy access to make changes.
4	Y	Coordinates were very useful. The description was not extremely useful. Use plain English (i.e., TEL or SA-x) If it's a decoy, just say decoy).

B. Was any important information not displayed or not easily accessible? Please explain.		
Subject #	Y/N	Comment
1	Y	Target coordinates. Recommend putting the confidence level on the GD with the ID. The level should be something easy for the operator to make a targeting decision (i.e., % or scale).
2	Y	The display of normal GD was difficult and caused loss of SA.
3	N	No comment
4	N	No comment

C. Did you find the ATR information useful? Please explain what was useful or unnecessary regarding the ATR information.		
Subject #	Y/N	Comment
1	Y	The ATR cueing symbology enabled operator to quickly find the target and potential targets. The resolution of the ESAR is extremely beneficial, allowing the operator to pass targeting information.
2	Y	It provided good insight about possible targets and types.
3	Y	When you get to the 3rd level of detection, need to show a meaningful confidence level in both info and on GD.
4	Y	Yes, but it should also have a percent certainty (e.g. TEL Up %80).

D. Did the ATR Symbology/Cueing cause confusion or clutter the display? If yes, please explain.		
Subject #	Y/N	Comment
1	N	I liked the fact that the symbology was operator-selectable—symbol, color, and display/hide function.
2	Y & N	We need to have access to normal GD to maintain operational SA.
3	N	
4	N	

E. Were there any problems in accessing / handling workstation information		
Subject #	Y/N	
1	N	
2	Y	The files listed for view were in reverse order of normal interest. The last file created should be the first one available for view, not the last.
3	Y	You need to be able to use ft or meters for distance measurements in the GD. Operator specify canonical type.
4	Y	The method of accessing ESAR-8 was somewhat painful. You shouldn't have to refresh every time to get the new SARs. Should be shown in the TD automatically.

F. What is your assessment of the value of the ATR Cues/Symbology overlaid on an image.	
Subject #	
1	Significantly Positive
2	Significantly Positive
3	Significantly Positive
4	Somewhat Positive

G. Rate Impact that the following information had on your SA.

4 = Somewhat Positive 5 = Significantly Positive

Subject #	Target Description	Target Coordinates		ATR Cue Boxes	ATR Results Summary	ATR Box Color Coding
1	5	4		5	5	5
2	5	4		5	4	5
3	5	5		5	4	5
4	4	4		4	3	4

H. How was your WORKLOAD affected by receiving the following types of information:

2 = SW Increased 3 = Same 4 = SW Decreased 5 = Signif. Decreased

Subject #	Target Description	Target Coordinates		ATR Cue Boxes	ATR Results Summary	ATR Box Color Coding
1	2	3		5	2	4
2	2	2		2	2	2
3	Lab demo only	N/A		N/A	N/A	N/A
4	3	4		4	3	4

How would you improve the application of the ATR information to workstation display?

1: I would like to see the results incorporated into the normal Joint STARS Graphics Display, instead of being a separate display. This would allow an operator to have all available information about a target (i.e., Threat information, Order of Battle, and other Joint STARS information) on one integrated display. This would increase an operator's SA and decrease workload by not having to switch between windows (displays).

Would like to have a simple "confidence level" or factor displayed along with the ATR cue boxes. Something that the operator could use to determine the confidence that the algorithm has correctly identified the target. I believe this will be necessary in making targeting decisions. It must be simple, like 60, 70, 80%, or a numerical scale.

2: It needs to be implemented into the normal ground display to allow continuous SA. Otherwise, this becomes one person's only task.

3: It needs to be integrated somehow into the system, not a stand alone system.

4: See previous comments. Put a simple Bearing/Range switch action in the window when using ATR.

II. ESAR E–4 & E–8 Imagery

A. Did you use the E-4 SAR imagery during the mission?		
Subject #	Y/N	Comment
1	N	Lab only.
2	Y	Little better detail in area viewed.
3	N	NA
4	N	NA

B. What is your assessment of the value of the ESAR E-4 image capability in aiding target acquisition?	
Subject #	
1	NA
2	Somewhat Positive
3	NA
4	NA

C. Did you find the ESAR E-8 imagery useful?		
Subject #	Y / N	
1	Y	Better resolution than normal SAR significantly increases SA.
2	Y	The definition of these images was enhanced and provided increased confidence of possible IDs provided.
3	Y	There was much more detail than normal SAR imagery.
4	Y	It provides a higher resolution picture.

D. Did the E-8 imagery significantly affect your visual fatigue?		
Subject #	Y/N	
1		Lab demo.
2	N	It didn't cause any more visual fatigue than viewing other SAR images.
3	N	No more than normal SAR.
4	N	

E. What impact did the ESAR E-8 image have on your SA?	
Subject #	
1	Significantly Positive
2	Somewhat Positive
3	Significantly Positive. If ESAR 8 were integrated into the GD, definitely sig. positive.
4	Somewhat Positive

F. Were there any difficulties working the ESAR E-8 imagery on the JSTARS workstation?		
Subject #	Y/N	
1		Lab
2	Y	See comments above.
3		Viewed in lab.
4		No

G. Was the E-8 image useful in target acquisition and identification?		
Subject #	Y/N	
1	Y	Very useful in acquisition. I don't have any training or enough experience using the imagery in identification.
2	Y	Provided increased visual ability on the OWS. Provides additional confidence in ID provided and forwarded to other agencies.
3	Y	Yes, with the ATR functions.
4	Y	Yes, if the ATR program works when it helps battle managers pick out valid targets on battlefield.

III. Human Machine Interface

A. Did you find the Human Machine Interface "user friendly"?		
Subject #	Y/N	
1	Y	See ADDITIONAL COMMENTS
2	N	Problems with the list, as described earlier. Loss of display when trying to view normal GD. More operator input is required, if future implementation will occur.
3	Y	
4	N	Didn't like the fact that you had to refresh to get new SARs in the TD.

B. What impact did the Human Machine Interface have on your workload?	
Subject #	
1	None
2	Somewhat Negative. Increased actions based on SA required.
3	Somewhat Positive
4	Somewhat Negative. See above

C. Please describe any image handling or targeting operations that were easier to perform using the new interface:	
Subject #	
1	No comment
2	Greater degree of confidence in ID presented.
3	Definitely enhances the operators ability to interpret the image; by allowing more detail.
4	NA

D. Please describe any image handling or targeting operations that were more difficult to perform using the new interface:	
Subject #	
1	NA
2	See response in III A.
3	When you crop out a portion of the image to save, on that image we lost the Lat/Long position. It was represented by 6 digits.
4	NA

E. Was the HMI easy to learn and understand?	
Subject #	Y/N
1	Y
2	Y
3	Y
4	Y

F. What is your assessment of the value of the Human Machine Interface to the operation of the new system capabilities?	
Subject #	
1	Somewhat Positive
2	Somewhat Negative to None
3	Somewhat Positive
4	Somewhat Negative

** Please add any Additional Comments you have concerning the ESAR/ATR/MTI system:

Sub 1: Would like to see it incorporated if possible. If not, provide the confidence of the ID as described earlier Also, display coordinates below the ID. The coordinates must be operator selectable in the system, i.e. Lat/Long, UTM, or Georef. Lat/Long in either DMS or DMM.

Sub 2: Good, but there are areas that could definitely be improved for the operator.

Sub 3: Integration of the ESAR 8 image and ATR products into the GD would definitely enhance SA (by overlaying these products on background info.—i.e., maps, carto, etc.). See Back...**[MISSING]**

Sub 4: No additional comments.